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| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|-----------------|-------------|----------------------|---------------------|------------------|
| 10/701,476      | 11/06/2003  | Keiji Fujita         | 04329.3172          | 8591             |

22852 7590 07/07/2005

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EXAMINER

PHAM, THANHHA S

ART UNIT PAPER NUMBER

2813

DATE MAILED: 07/07/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

**Office Action Summary**

Application No.

10/701,476

Applicant(s)

FUJITA ET AL.

Examiner

Thanhha Pham

Art Unit

2813

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 04/11/05.
- 2a) ☐ This action is **FINAL**.                      2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 17-33 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 17 -18, 20-28, 30-31 and 33 is/are rejected.
- 7) ☒ Claim(s) 19,29 and 33 is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 06 November 2003 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All    b) ☐ Some \*    c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- |  |  |
|--|--|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892)   | 4) <input checked="" type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)                                   | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152)                        |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)<br>Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____   |

## DETAILED ACTION

This Office Action is in response to Applicant's Amendment dated 04/11/2005.

### *Claim Objections*

1. **Claim 21 is objected to because of informalities. Appropriate correction is required to clarify scope of claim.**

► With respect to claim 21,

line 4, "a semiconductor substrate" should be changed to "said semiconductor substrate" to clarify scope of claim.

### *Claim Rejections - 35 USC § 102*

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

2. **Claims 17 and 20-22 rejected under 35 U.S.C. 102(b) as being anticipated by Allen et al [US 4,420,441].**

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► With respect to claim 17, Allen et al (fig 1-4 and col 1-21) discloses the claimed method for manufacturing a semiconductor device comprising:

forming a porous insulating film above a semiconductor substrate (col. 2 lines 22-31, col 14 lines 44-67 and col 15 lines 1-2);

forming a recessed portion on a surface of said porous insulating film (col. 2 lines 32 and col. 15 lines 14-27); and

filling said recessed portion with a conductive material for form at least one of a plug and a wiring layer (col 2 lines 32-35 and col. 15 lines 28-54)

wherein said porous insulating film is irradiated with electron beam to enlarge the size of pores of said porous insulating film (col. 2 lines 22-31, col 3 lines 50-63, col. 10 lines 10-28: *step c), irradiating the insulating film with electron beam to remove porogen would enlarge pores in the porous insulating film*).

► With respect to claim 20, Allen et al. (col. 15 lines 27-40) discloses filling said recessed portion with said conductive material to form at least on of said plug and said wiring layer including depositing a Cu layer through a barrier metal film.

► With respect to claim 21, Allen et al. (cols: 4-15) discloses wherein, in forming said porous insulating film, said pores of said porous insulating film are formed by procedures including:

coating a varnish (*composition including B-stage dielectric material having polymeric porogen dispersed therein*) on said semiconductor substrate to form a coated layer;

heating said coated layer to vaporize solvent in said varnish (col. 11 lines 60-67 and col 12 lines 1-28: curing composition including the B-stage dielectric material having polymeric porogen by heating would vaporize a solvent in said varnish);

further heating said coated layer to take place a chemical bonding reaction (*further heating to cure the composition to polymerize the composition*).

► With respect to claim 22, Allen et al (col.11) discloses said varnish (composition including B-stage dielectric material having polymeric porogen) is prepared by dissolving a porous insulating material selected from the group consisting of methylsilsesquioxane, polymethyl siloxane, polyarylene and polyarylene polyether (e.g. methylsilsequioxane).

### ***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

**3. Claims 18 and 23 are rejected under 35 U.S.C. 103(a) as being unpatentable over Allen et al [US 6,420,441].**

With respect to claims 18 and 23, the claimed range pore size and a weight average molecular weight of methylsilsesquioxane are considered to involve routine optimization while has been held to be within the level of ordinary skill in the art. As

noted in *In re Aller* 105 USPQ233, 255 (CCPA 1955)., the selection of reaction parameters such as temperature and concentration would have been obvious.

"Normally, it is to be expected that a change in temperature, or in concentration, or in both, would be an unpatentable modification. Under some circumstances, however, changes such as these may be impart patentability to a process if the particular ranges claimed produce a new and unexpected result which is different in kind and not merely degree from the results of the prior art...such ranges are termed "critical ranges and the applicant has the burden of proving such criticality... More particularly, where the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation."

*See also In re Waite* 77 USPQ 586 (CCPA 1948); *In re Scherl* 70 USPQ 204 (CCPA 1946); *In re Irmischer* 66 USPQ 314 (CCPA 1945); *In re Norman* 66 USPQ 308 (CCPA 1945); *In re Swenson* 56 USPQ 372 (CCPA 1942); *In re Sola* 25 USPQ 433 (CCPA 1935); *In re Dreyfus* 24 USPQ 52 (CCPA 1934).

**4. Claims 24-28, 30-31 and 33 are rejected under 35 U.S.C. 103(a) as being unpatentable over Allen et al [US 6,420,441] in view of Moghadam et al [US 2003/0232495].**

► With respect to claims 24, 28, 30 and 33, Allen et al substantially discloses the claimed method including irradiating said porous insulating film with electron beam. Allen et al does not expressly mention said porous insulating film is irradiated with electron beam in the presence of at least one gas wherein said gas being selected from

the group consisting of N<sub>2</sub>, O<sub>2</sub> and H<sub>2</sub> and said is excited to etch the inner wall of said pores .

However, Moghadam et al (text [0020], [0037]-[0041], [0133]-[0175], [00203]-[0209]) discloses using electron beam radiation in presence of at least one gas selected from the group consisting of N<sub>2</sub>, O<sub>2</sub> and H<sub>2</sub> (text [0037]) and the porous insulating film is etched (text [0134] & [0204]) to improve mechanical properties and stability of the porous insulating film.

Therefore, at the time of invention, it would have been obvious for those skilled in the art to modify process of Allen et al to irradiate the porous insulating film with electron beam in condition as being claimed, per taught by Moghadam et al, to improve mechanical properties and stability of the porous insulating film.

► With respect to claims 25-27 and 31, the claimed ranged parameters for electron beam irradiation are considered to involve routine optimization while has been held to be within the level of ordinary skill in the art. See *In re Aller* 105 USPQ233, 255 (CCPA 1955); *In re Waite* 77 USPQ 586 (CCPA 1948); *In re Scherl* 70 USPQ 204 (CCPA 1946); *In re Irmischer* 66 USPQ 314 (CCPA 1945); *In re Norman* 66 USPQ 308 (CCPA 1945); *In re Swenson* 56 USPQ 372 (CCPA 1942); *In re Sola* 25 USPQ 433 (CCPA 1935); *In re Dreyfus* 24 USPQ 52 (CCPA 1934).

***Allowable Subject Matter***

5. Claims 19, 29 and 32 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

6. The following are statements of reasons for the indication of allowable subject matter:

► Recorded Prior Art fails to disclose or suggest the combination of the process steps as recited in the base claim 17 including wherein enlarging the size of said pores through irradiation of electron beam onto said porous insulating film is performed subsequent to filling said recessed portion with said conductive material as characteristics in claim 19.

► Recorded Prior Art fails to disclose or suggest the combination of the process steps as recited in the base claim 28 including wherein said porous insulating film is an organic silicone film and said inner wall of said pores is etched through elimination of CH<sub>3</sub> group from said organic silicone film as characteristics in claim 29.

► Recorded Prior Art fails to disclose or suggest the combination of the process steps as recited in the base claim 28 including wherein said porous insulating film is an organic insulating film and said inner wall of said pores is etched through elimination of carbon from said organic insulating film as characteristics in claim 32.

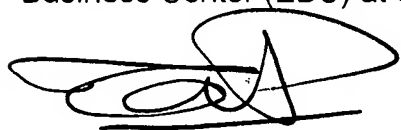


**Conclusion**

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Thanhha Pham whose telephone number is (571) 272-1696. The examiner can normally be reached on Monday and Thursday 9:00AM - 9:30PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Carl Whitehead can be reached on (571) 272-1702. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

A handwritten signature in black ink, appearing to be 'Thanhha Pham', with a stylized, cursive script.

Thanhha Pham  
Patent Examiner  
Patent Examining Group 2800